The official voice of the Air Force Research Laboratory

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December 2004 Volume V, Issue X

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CGOs skydive with Golden Knights

by 1st Lt. Jessica Phelps, Space Vehicles Directorate

HANSCOM AIR FORCE BASE, Mass. — Imagine crawling out of an airplane at 13,000 feet, gripping a single bar fastened to its outer skin and waiting, not to land, but to jump and spend the next 65 seconds plunging toward the earth at speeds averaging 125 miles per hour.

Two Hanscom company grade officers spent one November weekend doing just that.

1st Lt. Tamilyn Becker, Air Force Research Laboratory research scientist and Capt. Giesela Alpheis, Electronic Systems Center AWACS budget analyst, are both skydiving enthusiasts and teamed up with the Army Golden Knights, the elite Army skydiving team, during the Golden Knights 5th Annual Inter-service Parachuting Competition at Laurinburg-Maxton Airport in North Carolina Nov. 5 through the 8.

"This event was so amazing because it brought military members who have a passion for the sport of skydiving together," Lieutenant Becker said.

Captain Alpheis went to the event with 29 jumps under her belt and was able to add nine more to her list.

"I did my first jump of the weekend with the 2004 Overall World Skydiving Champion," Captain Alpheis said. "He had over 10,000 jumps and was completely down to Earth. I didn't find out until later that he was the world champion when I saw his picture on the wall."

Lieutenant Becker, who has been jumping for five years, had 122 jumps to her credit before the weekend and added 15 more to her count.

Jumping with the Golden Knights during a competition weekend added to the excitement for both skydivers. It also opened opportunities to make friends within the military skydiving community.

"I keep in touch with jumpers who I met at last year's competition and jumped with them again this year," Lieutenant Becker said.

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Captain Alpheis (far left) and AFRL's Lieutenant Becker (center) skydived with two members of the Golden Knights during the Inter-service Parachute Competition. (Courtesy Photo)

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December 2004

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news@afrl is published monthly by the Office of Public Affairs of Air Force Research Laboratory Headquarters. Contact the office at AFRL/PA, Building 15 Room 225, 1864 4th St., WPAFB, Ohio, 45433-7132, (937) 656-9872, or send e-mail to AFRL/PA@afrl.af.mil. Contents of this newsletter are not necessarily the official views of, or are endorsed by, the U.S. Government, the Department of Defense or the Department of the Air Force. The editorial content is edited, prepared and provided by this office. Photographs are official U.S. Air Force photos unless otherwise indicated. Submission guidelines are available from this office or on-line. Electronic copies and additional full-text articles are available online at: http://www.afrl.af.mil/news.

Laser fighter participates in war-gaming exercise

by J. Rich Garcia, Directed Energy Directorate

KIRTLAND AIR FORCE BASE, N.M. — F-16 pilots that participated in a computerized war-game exercise Oct. 26 were armed with a simulated laser cannon developed by the Air Force Research Laboratory.

During the exercise, called Advanced Concepts Event (ACE), pilots used the newly-developed laser-armed F-16 simulator to become better prepared for aerial combat once laser weapons become available. The simulator also allows Air Combat Command to develop tactics, techniques and procedures that will be needed in future laser battles.

Taking place at Kirtland, ACE is an exercise for all the military services. It incorporates simulators from throughout the country, networked to Kirtland. Officials note that the event offers the intensity of real exercises, providing participants the opportunity to wargame future weapon systems to determine military worth to the warfighter.

This laser simulator, known as High-Energy Laser Fighter, or HEL Fighter, was developed with assistance from F-16 pilots assigned to the New Mexico Air National Guard, another Kirtland-based unit.

"We started this effort nearly four years ago," said Rudy Martinez, the HEL Fighter project officer at the Directed Energy Directorate. "We wanted to merge an F-16 simulator with a laser weapon system so that a pilot could blend flying experience with the skills needed to operate a revolutionary speed-of-light weapon."

Martinez said, "A pilot would fly his F-16 differently in a laser battle compared to a more traditional fight using guns or missiles. With guns and missiles, a pilot has to maneuver to approach a target from behind or from the side. But with a laser weapon, that pilot can have more latitude. That's because the laser fires through a turret mounted underneath the plane. The turret allows the laser to fire on either side or straight ahead, so the pilot doesn't have to do as much maneuvering."

"Working as a team, we put together a pretty good simulator," Martinez said. "But this was not enough. We still needed to get it into the hands of Air Combat Command operators to get feedback on how well it works, whether it was realistic enough or not. So we transitioned it to a facility in Mesa, Ariz., called the Warfighter Training Research Division of the Human Effectiveness Directorate, where they have four F-16 simulators. By loading all four simulators with our model, we were able to fly multiple, simulated, laser-armed aircraft in a single battle."

The simulators at Mesa are also more sophisticated than the ones at Kirtland, being able to incorporate a 360 degree "out of the cockpit" view in their simulations.

Improvements to the HEL Fighter are in the works. One of those improvements, according to Martinez, is to go beyond reliance on radar to acquire targets in an air battle. Traditionally armed F-16s use radar to locate and zero in on their airborne targets. When using guns and missiles, the entire aircraft is the target and the radar provides the information needed to hit a target. But with a laser, the targeting can be much more precise. A pilot can focus on a particular portion of a target – engines, armament or fuel tanks for example. The simulator program is being modified to provide that level of exactness.

A laser-armed fighter aircraft is still a few years away. Under development are solid-state lasers and compact electrical sources that can power high-energy laser weapons. Until then, Martinez adds, that experience will only be available through simulators like the HEL Fighter and exercises such as ACE. @

Full-scale F-35 flies above central New York hilltop

by Francis L. Crumb, Information Directorate

ROME, N.Y. — Perched atop a pedestal overlooking a rural valley in central New York sits the nation's air warrior of the future.

Sophisticated antenna testing is currently underway on the Lockheed Martin F-35 Joint Strike Fighter at the Air Force Research Laboratory's Information Directorate's Newport Antenna Research and Measurement Facility.

The full-scale F-35 model was designed and built by Advanced Technologies Inc. in Newport News, Va. The model weighs 8,500 pounds and has the capability to simulate all three variants of the JSF with interchangeable wing and tail components.

The Joint Strike Fighter is a stealthy, supersonic multi-role fighter designed to replace a wide range of aging fighter and strike aircraft, including the AV-8B Harrier, A-10, F-16, F/A-18, and the United Kingdom's Harrier GR 7 and Sea Harrier. Three variants derived from a common design will ensure that the F-35 meets the performance needs of the Air Force, Navy and Marine Corps, as well as allied defense forces worldwide. Lockheed Martin is developing the F-35 in collaboration with its principal partners, Northrop Grumman and BAE Systems.

AFRL's Newport site, a world-class antenna measurement facility that has been in existence for over 30 years, provides multiple outdoor test ranges. Home to the "Upside-Down Air Force," the facility owns models of all Air Force tactical air assets and, in recent years, has added models of aircraft from other services.

"Lockheed Martin has contracted with AFRL in an attempt to mitigate any future problems," said Captain Gabe Mounce, program manager. "The goal is to identify problems before the aircraft enters a production mode and flight testing. This is an example of the smart way to test."

The Newport facility is used to evaluate antennas and antenna systems in a far field "free space" environment, to determine radiation pattern changes due to airframe effects, to evaluate antenna-to-antenna system coupling and to support an advanced antenna measurement technology development. Located 26 miles east of AFRL's Rome Research Site, the facility consists of two hilltops with six data gathering locations and ten measurement ranges. The two hills are 1.5 miles apart, with a 430-foot valley in between. Transmit and receive equipment and heavy duty three-axis aircraft pedestals are located on each hilltop.

"In only eight minutes, engineers can obtain more data than flying the still-to-be-built F-35 for more than two hours," said Capt. Mounce. "We will provide Lockheed Martin very accurate data on how the antennas are performing. This is the only facility of its kind in the Air Force. We are fortunate to be able to provide Lockheed Martin and the F-35 System Program Office with vital testing that is faster, smarter and more economical."

A full-scale F-35 Joint Strike Fighter model is perched atop a pedestal overlooking a rural valley in central New York.

"The beginning of aperture testing in this world-class test facility is a significant achievement in the F-35 JSF program," said Bob Elrod, Lockheed Martin executive vice president and F-35 JSF program general manager. "This is a key milestone on the way to our first flight date in 2006."

In addition to providing and managing their outdoor antenna test ranges, AFRL is providing personnel from its Site Operations Division fabrication shop to manufacture replicas of the F-35's external fuel tanks, weapons and landing gear to support the JSF test program. @

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Jumping with the Golden Knights also meant getting world class instruction for a fraction of the cost.

"The Golden Knights are dedicated to helping others to improve and jump safely," Captain Alpheis said. "It was also free. My nine coached jumps would've cost $540 if I'd done them at a drop zone in Massachusetts."

Experiencing the rush of jumping out of an airplane with other military members who love the sport made for a memorable weekend for both Hanscom skydivers.

"The Golden Knights are one of the top competition teams in the world," Lieutenant Becker said. "Not only are they talented, but they are very professional when they are coaching you. From going over the skydive before getting on the plane, making sure everything is ready to go in the plane, to a debrief after the skydive is complete — they are truly an amazing group of people."

The opportunity to jump with the Golden Knights is a benefit for military members who are certified skydivers. Both Captain Alpheis and Lieutenant Becker are certified and participate in this sport on a regular basis. @

B-52 aircraft to adopt AFRL-developed hydraulic fluid

by Timothy R. Anderl, Materials and Manufacturing Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — A fire-resistant hydraulic fluid developed by Air Force Research Laboratory Materials and Manufacturing Directorate experts will now be used in more than 90 percent of B-52 bomber components, increasing the aircraft's survivability and operational safety.

A B-52 was used to test an AFRL developed fire-resistant hydraulic fluid

In the past, B-52s used a flammable, petroleum-based hydraulic fluid, according to C. Ed Snyder of the directorate's fluids and lubricants group. The replacement fluid has a higher flash point and reduced flammability, key to safety in flight. It also allows aircraft to operate at temperatures as low as minus 65 degrees Fahrenheit, and in high temperature environments for extended periods of time.

"The hazards associated with the flammability characteristics of hydraulic fluids are well known," Mr. Snyder said. "They are required to function in high pressure hydraulic systems in the presence of a variety of ignition sources."

Though fire resistant fluids will burn, Mr. Snyder said they are significantly more difficult to ignite and are much less likely to spread a fire after ignition than a non-fire resistant fluid.

Jimmy Vo, a B-52 systems engineer at Oklahoma City Air Logistics Center, said revisions to the B-52 technical orders, reflecting the new hydraulic fluid requirement, will be official by January 2005. Experts will also conduct tests to determine if the landing gear struts and wing tip protection struts can be converted to the fire-resistant fluid.

Hydraulic fluids are critical to the safety of flight material for all Air Force aircraft. Hydraulically actuated mechanisms operate a large number of aircraft functions, including highly sophisticated flight controls, landing gear operation, control of rudder flaps and accessory door actuation, Mr. Vo said. Hydraulic fluids also lubricate aircraft systems and reduce heat generated during operation.

Nonstructural material experts from the directorate's fluids and lubricants group dedicated significant research and development activities to preventing hazards caused by hydraulic fluids. Two synthetic hydrocarbon based fire resistant hydraulic fluids were successfully developed to meet this requirement and were compatible with the systems and design of aircraft, including the B-52.

A materials and development program in the 1960s and 1970s led to development of the new fluid so that it is compatible with, and an appropriate drain-and-fill replacement for the older petroleum-based product. It also didn't require any type of retrofit of hydraulic system materials or components, Mr. Snyder said.

Officials initially authorized converting all Department of Defense aircraft to this fluid except for aircraft required to be airborne on short notice. Those aircraft were not converted because the viscosity of older fluid was higher at minus 65 degrees Fahrenheit than was the new product.

Mr. Snyder said aircraft using the new product were found to require longer warm-up times for the flight controls before the aircraft could take-off—a phenomenon that was considered unacceptable— so those aircraft continued to use the flammable fluid.

Subsequently, a requirement developed for a compatible, drain-and-fill replacement for the old, flammable hydraulic fluid that would have the same low temperature operational capability, but would also offer improved fire resistance.

AFRL experts developed the new fluid, based on a modified synthetic hydrocarbon polyalphaolefin and a similar additive package, and extensive testing and evaluation proved it is an appropriate replacement for the older, flammable hydraulic fluid in all military and some small commercial aircraft.

"Based on thermal stability measurements, fluid film thickness, and volatility, (the new fluid) is usable in low and high temperature environments for extended periods of time and is significantly less flammable," said Lois Gschwender, a fluids and lubricants group member.

"With conversion of the B-52 to a fire resistant hydraulic fluid, only a few Air Force aircraft still use the flammable fluid," Ms. Gschwender said. "We are hoping they will convert to one of the safer, superior performance, fire resistant hydraulic fluids in the near future." @

PR scientist elected as American Carbon Society chairman

by Ranney Adams, Propulsion Directorate

Dr. Wesley Hoffman

EDWARDS AIR FORCE BASE, Calif. — Air Force Research Laboratory scientist Dr. Wesley Hoffman has been elected the chairman of the American Carbon Society.

Dr. Hoffman leads the AFRL Propulsion Directorate's high temperature components group at the Edwards Research Site.

Together with 450 national and international members of the American Carbon Society, Dr. Hoffman will spend the next three years promoting the progress of carbon materials and emerging technologies like nanotubes, carbon fibers, and super-strong composites to improve everyday life.

Dr. Hoffman and his research team were recently honored by the Federal Laboratory Consortium with the award for excellence in technology transfer. The team's efforts on In Situ Densification of carbon-carbon composites provided a low-cost, rapid method to produce high quality composite material. Carbon composites can be utilized for aircraft brakes, rocket nozzles, exit cones and nose tips. This led to agreements with several aerospace companies for aircraft brake materials, and SMJ Carbon, a spin-off company, for numerous other applications.

The American Carbon Society was established to promote carbon research and to share the progress of its science and technology. The society is managed by its elected members to work on a national and international level. @

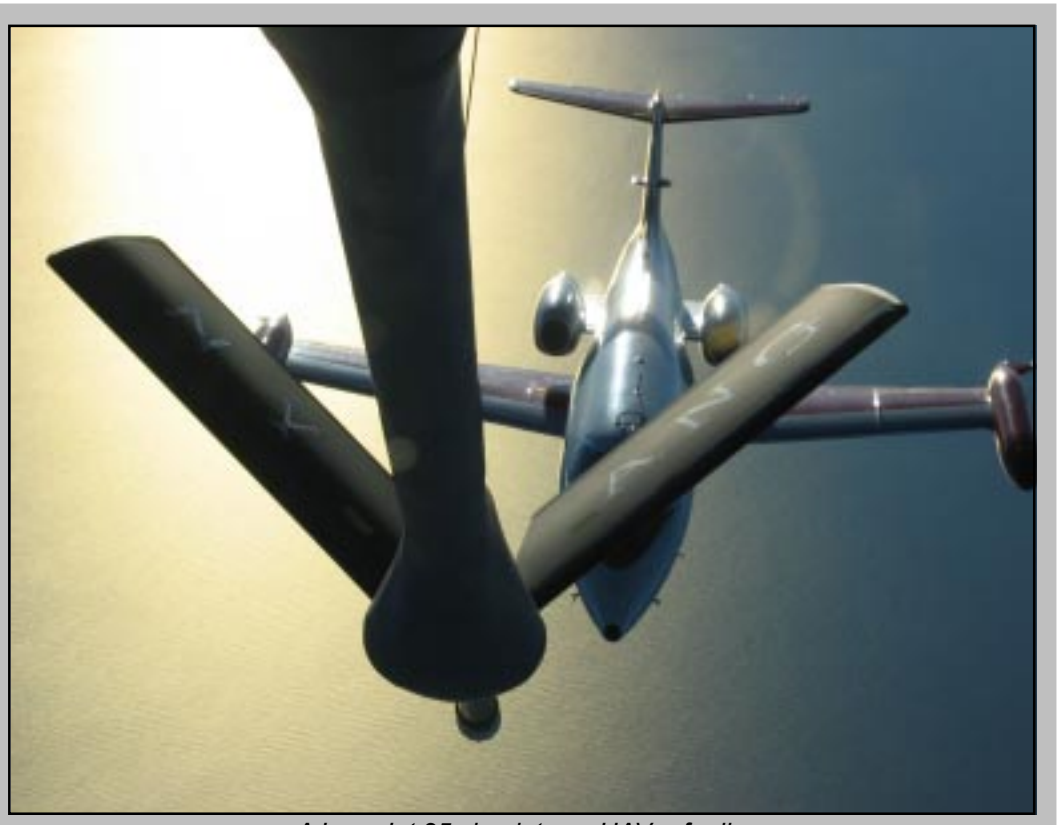
UAV automated aerial refueling one step closer to reality

by Melissa Withrow, Air Vehicles Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — The Air Force Research Laboratory's Air Vehicles Directorate engineers have successfully completed a flight demonstration that will help them evaluate the feasibility of using precision global positioning system (PGPS) and electro-optical technology for Unmanned Air Vehicle (UAV) automated aerial refueling (AAR) applications.

During approximately 14.5 hours of flight tests, a Lear Jet 25 from General Dynamics Advanced Information served as a surrogate UAV for simulated aerial refueling from a KC-135 Stratotanker from the 107th Air Refueling Wing, New York Air National Guard.

VA scientists successfully collected quality data from both the PGPS and the electro-optical sensor. They are using these test results to determine safe refueling speeds, possible tanker interference with PGPS reception, and the effectiveness of using electro-optical sensors for precise UAV positioning during AAR. In addition, they will use the data to create a flight control algorithm that will autonomously fly the surrogate UAV in the future.



A Lear Jet 25 simulates a UAV refueling

AAR is a challenging task, balancing performance with reliability and safety. For it to be possible, the PGPS or electro-optical sensors must provide the aircraft position control within inches of accuracy. UAVs capable of refueling in the air will have the persistence to stay on station for extended periods of time and the ability to join the fight from bases thousands of miles away.

The Naval Air Systems Command, Air Force Flight Test Center, Tinker Air Force Base, General Dynamics, Rockwell-Collins, Boeing, and Northrop Grumman all made valuable contributions to this VA-led effort. @

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Due to the number of submissions we receive, some sections of *news@afrl* are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research Laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

Roundups

- **Announcement results in multimillion dollar contracts**
- **AFRL awards $2.1M contract for speech processing research**

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To submit L@b L@urels or Roundups from your directorate, send a query to AFRL Public Affairs at:

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http://www.afrl.af.mil/news.

Air Force FALCON tested on Edwards Test Stand 2A

by Ranney Adams, Propulsion Directorate

EDWARDS AIR FORCE BASE, Calif. — Supporting a Defense Advanced Research Projects Agency (DARPA) and the Air Force Small Launch Vehicle (SLV) program called 'FALCON', Air Force Research Laboratory Propulsion Directorate personnel will begin conducting hybrid rocket testing at the Edwards Research Site this month.

The testing is part of FALCON's ten-month long Phase II effort to develop and demonstrate an affordable and responsive space lift capability. The program goal is to develop a low-cost, responsive launcher capable of placing a small satellite, weighing 1,000 pounds, into a circular 100 nautical mile orbit.

The laboratory's recently renovated Test Stand 2A, rededicated on Jan 14, 2004, will initially be used to conduct hybrid rocket horizontal tests with 20,000 pounds of thrust. The family of rockets being proposed can be as large as 250,000 pounds of thrust. A hybrid rocket's propellants typically consist of a rubber-like solid fuel 'grain' and a liquid oxidizer. The designation 'hybrid' refers to this blend of solid and liquid rocket technologies.

The hybrid rocket is to be designed and built for Lockheed Martin Corporation by their Space Systems Company at Michoud Operations, located near New Orleans, La. The contract award to Lockheed Martin by DARPA was announced on Sept. 15, 2004.

Large hybrid rockets were last fired at AFRL in the late 1980's when the American Rocket Company (AMROC) performed testing at Edwards under the Commercial Space Act. Hybrid propulsion was also recently used by SpaceDev for propelling the SpaceShipOne rocket.

Helping to assure that AFRL's Edwards Research Site was the most modern and capable rocket research and test facility in the nation, efforts by the California Space Authority (CSA) helped identify space infrastructure needs and gained support for the refurbishment of numerous rocket test stands and facilities at the site. CSA's support was instrumental in getting Test Stand 2A up and operating again over the last three years.

Test Stand 2A is the Department of Defense's most capable rocket component development facility, capable of performing developmental testing on the largest rocket engines under development today. In the 1960's, Test Stand 2A was important in resolving the combustion instability problems that plagued the development of the Apollo Program's main booster engine. Demonstrating its testing flexibility, AFRL is putting the finishing touches on the refurbished Test Stand 2A. The DARPA FALCON program funded facility improvements during Fiscal Year 2004, customizing fixtures and propellant plumbing for the FALCON tests.

Nearly every American launch vehicle, missile, booster, or space propulsion system used today derives its technology and testing validation from research and test efforts at AFRL's Edwards Research Site. @